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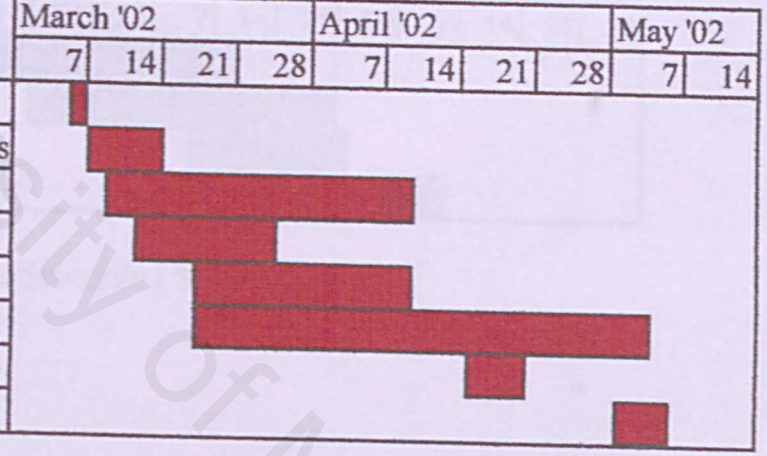

Figure 1.1 Development Schedule (Semester Khas)

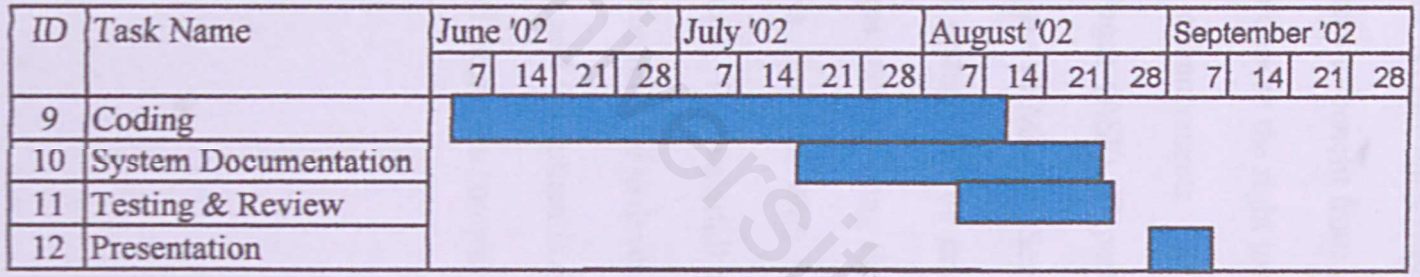

Figure 1.2 Estimated Developement Schedule (Semester 1)

ABSTRACT

Online learning module for STPM chemistry is a web-based multimedia system that can provide information on STPM chemistry. Besides being an online tutor, it also offers search capability and real-time quizzes. The system focuses on delivering content, which are the basics for STPM chemistry for better understanding of the subject and also enable non-students to benefit from it. The findings in the Literature Review were made as a reference to choose the right tools to develop this system, which is data driven and has multimedia enhancements. In reviewing the tools to fulfill such requirements, Active Server Pages (ASP), Hypertext Markup Language (HTML), Virtual Reality Markup Language (VRML), VBScript and JavaScript seemed appropriate to program the system. The system will be developed in Windows 98 environment, thus related software packages such as using the Macromedia Dreamweaver, Microsoft FrontPage, Microsoft Access, Personal Web Server (PWS), Adobe Photoshop, and Macromedia Flash will be used. The waterfall model together with Data Flow Diagram the two method that will be referred to develop the system. The final requirements are met in the System Analysis and the system is designed in various forms in System Design. Finally after the proposal stages are complete the system will be developed, implemented, tested and refined.

Online learning is learning that is delivered through the Internet (though it can take place through an intranet). Both the lecturer and student need a computer with Internet access to interact in a flexible manner. They do not need to meet face to face to facilitate learning. To start the online learning process, the lecturer has to upload learning materials onto the Internet and give students the Web address.

We shall now address the issue on why learns online. There are three main reasons why you should enroll in a distance-learning course:

i. Time restrictions

There are students who cannot go to an educational institution at a scheduled time. They might me involved in shift work of have heavy responsibility at home.

ii. Place restriction

Students might live far from the educational institutions. They sometimes have no means of transportation, or have illness or disability.

iii. Flexibility

Online learning will allow students to learn at the place that suites them. This will allow students to concentrate on learning because there will be no distraction.

1.2 IMPORTANCE OF PROJECT

STPM students have to face a tough syllabus compared to when they were in SPM levels. A lot of time must be spent to study. Lessons taught in schools are not enough to score well in the examinations. After examining the tree issues stated above regarding the reasons enrolling in an online course, I find that it is very applicable to STPM students. There is a great need to develop an online learning web site for STPM subjects.

The Ministry of Education has plans to implement Virtual Schools in Malaysia. The online learning module of this project, after refinement can be incorporated in the Virtual School project.

1.3 PROJECT OVERVIEW

As stated in the Importance of Project, there is a serious need to develop a online learning site for STPM subjects. But the this final year project will scale down that aspect into one topic. The topic is STPM chemistry. This project is aimed to develop an online **chemistry learning module for STPM chemistry.** It is a web site designed to fulfill this needs and will act as an online tutor to STPM students. Multimedia enhancement will be included into the web site, and more useful still, the site will be designed to be interactive. The system is to be named as **e-Kimia**.

1.4 PROJECT OBJECTIVES

The objectives below are in the form of measurable ones as it will state what the system to be developed should be able to do in terms of its task and functionality.

i. To design and develop web based system for learning/ teaching STPM chemistry.

ii. Develop an effective interesting tool with multimedia features, which will enhance learning process as the same time use new technology in teaching such as VRML.

iii. Enable up-to-date information to be shared publicly regardless which type of users they are. Example STPM students or information seekers.

iv. To cater those who want to learn outside a physical education institution.

1.5 PROJECT SCOPE

The scope of the project defines the overall requirement of the project and the aspects that are included in the project. Scope also describes the border of the system to be developed.

Here are the areas of the scope:

- Project scope.
- System scope.

PROJECT SCOPE

i. This online system is developed for STPM chemistry only.

ii. Only elements or content which are education based will be included.

SYSTEM SCOPE

The system is divided into two categories. They are:

- Administrator module.
- User Module.

i. Administrator module.

- Username and passwords

  This is security feature to protect the database from unauthorized users.

- Edit/Delete

  Administrator will be able to view, edit or delete user particulars from the database.

ii. User module.

- General information

  This is the main page has welcome statement and general information about the site.

- Learning mode

  This is the online learning engine. It includes notes according to topics, real-time tests, keyword search, 3D visuals and question bank.

- Site map

  It is a graphical representation to help navigate the page.

- Username and passwords

  To log as different users.

- Help

  This option will display help files.

- Registration

  User will have to register their particulars here.

- Links

Any educational related site will be given links.

2.0 LITERATURE REVIEW

2.1 ROLE OF LITERATURE REVIEW

This chapter covers a comprehensive literature review of other work on associated issues and fields of interest. The sources I have chosen are from two kinds of media. They are paper and paperless media. Paper materials in other words printed media, are such as books, news paper articles, related thesis and so on. On the other hand paperless media are such as from the Internet.

This chapter will cover in these areas

- Survey on existing online web sites.
- Survey on development tools and development platform.
- Online learning related concepts and issues.

2.2 APPROACH TO LITERATURE REVIEW

Here I will briefly explain how information had been collected. As mentioned above I used several types of media or approaches to gather information. Since Internet was used to search information, certain technique had to be applied to obtain good results. Some websites, which I knew the addresses, were simple to access. Since there was far more sites that haven't been discovered which could harvest more quality information, I had to use Internet search engines and directories and web portals. The search engines I used

are such as Google, Metacrawler and so on. To obtain good results combinations of keyword were used.

For printed materials books, journals and thesis's were used as a references. There was a need to this option because it is safe to use information on printed materials are valid. This assumption of mine is based on the fact that there will a body or individual of the mater with a superior knowledge in the field, who will evaluate the material before being published. For example journals are revised many times by others before it is published.

2.3 ONLINE LEARNING RELATED SITES

INTRODUCTION

The Internet is a network of various networks. The **WWW** (world wide web), which is a graphically oriented hypermedia system. It has been a tool for information sharing ever since it was started. Online web information is latest in the information highway.

Online systems are designed in a way that search is conducted online, and progress in an interactive, conventional fashion, making it more akin to the manual search. Online searches are conducted real time which means results are available almost immediately because the computer is capable of searching very fast despite the great number and size of files involved **[1].** It means that users can take advantage of new information as they find in order to adapt and refine their search strategies, a process known as feedback that has been found to improve he relevance of the materials.

2.3.1 WEB EVALUATION

One cannot accept information without examining the information beforehand. Presuming that information on the web sites would be accurate is something unwise to do. There is a need to evaluate the web. The evaluation can be divided into several categories **[2].**

Some evaluation criteria [3]:

i) Scope

Scope of the web content includes the items that are included in resource such as subject area, formats or materials covered. Aspects of the scope include breadth, which covers the completeness of the subject covered, depth of subject covered, time limitation and format.

ii) Content

The content concerns the evaluation of whether the information is factual or opinionated. The content should be evaluated whether it contains original information or simply links. Sites can be useful both as informational resources in themselves and as links to other information. Specific aspects relate to the accuracy, authority, currency and uniqueness of the resources. The information must be checked against other reliable or authoritative resources. The resource should be organized by a reputable organization or the individual involved should have a standing in the field. The sources of the information must be stated and the information must be verifiable. The contact source should be given for clarification of the information. The frequency or currency of the resource updated should be taken into consideration. The date of the updates should also correspond to the information in the resource. It is important to determine whether the organization or the person hosting the resource. The information in this resource should be available in other forms. Links to appropriate resources should be kept up-to-date.

Evaluation should cover the written text as well. The information content on the web still lies in the text and quality. It is irreplaceable for it is important for the content to be communicated clearly.

iii) Graphic and multimedia design

The visual effects should be appropriate to the purpose of the source. Navigational tools or design should embedded.

iv) Purpose

The purpose of the web site should be stated clearly. The resource should fulfill the stated purpose. The audience concerns the resources to cater to the need of the intended audience.

v) Review

The review on the web sites can determine the strength and the weaknesses of the range of the Internet resources.

vii) Workability

The resource should be both convenient and beneficial to use. Workability includes user friendliness as the special commands should be clear with help information available user interface issues addressed, the required computing environment should be flexible, searching information in the resource should be easy. The resource should be organized in a logical manner. There should be a good search engine that intuitive and provides an

index to the information content. The resource's browsability and organization should be ensured. Interactivity features should be included. The connectivity of the resource should be accessible with standard networking equipment and software. The reliability of access should be taken into consideration particularly that pertaining to high availability of the resources.

2.3.2 ANALYSIS OF SOME CURRENTLY RELATED SYSTEM

1. Pusat Bimbingan Siber SPM.

http://members.tripod.com/spm-siber/index2.htm [2002, April 5]

Personal evaluation

- Information in Bahasa Melayu. It is acceptable because in Malaysian education system Malay language is used for all levels of teaching therefore it is suitable for students.
- Notes, questions and pass year papers included for topics like Ekonomi Asas, Perdagagan, Prinsip Akaun and Mathematics. The topics are limited for SPM level.
- Set up by an experience teacher, Mr. Rithuwan. B. Nasir. E-mails can be sent to him about anything related to studies.
- Less informative, few features to visit. No search engine to search information users want or questions they need in studying.
- Forums and chat room not found which can encourage good communication between tutor and user.
- Features like "Buku Pelawat" to save personal details and "Tutor Rakan Sebaya" for users to give response (suggestion, advice, comment).
- Solutions not shown. Only answers are given. This is not an effective way for studying. Further more there is no online test.

2. Juara Cyber Tuition

http://www.e-juara.com [2002,April 5]

Personal evaluation

- Web site for PMR and SPM level.
- Topics Malay, English, Science and Mathematics. Notes and tutorials are given.
- No options for updating personal details and layout of personal interest.
- No help, search engine, chat room, question upload, analysis test results, latest news and etc.
- Other features like "AskJuara" (to guide and counsel students acedemic development). "Juara-Bank" (virtual library-endless information and links for fun research). "JuaraParents"(helpful parental tips). "JuaraGreetings" (personalized online greeting cards, wallpaper and screen savers). "JuaraClub" (online community where you can make friends and participate in existing club activities)

3. Online Education Web

http://www.eduweb.com.my [2002, April 4]

Personal evaluation

- All subjects for UPSR, PMR and SPM level.
- No pass year question and answers for tutorials are not given.
- No option to update personal details.
- Teachers who are experienced in local syllabus write its materials. Each topic got questions with notes plus solution prepared.
- Diagrams and maps are added to deliver more comprehensive explanation.
- Announcement for new features, forum, tips to face exams, search engine to link other pages and chat room are the other features available.

2.3.3 OVERALL COMMENTS ON EXISTING SYSTEM

From the analysis conducted above I have these systems have its strengths and weaknesses. My overall comments are below.

i. All the sites are attractive, filled with good ideas and functions well.

ii. No materials on STPM. It is mainly focused on PMR and SPM levels. This may due to the wide and harder syllabus for STPM subject where web developers might find it difficult to prepare the content. Although there are lesser students for STPM level in Malaysia, it will unfair for these students if there is no resource for them. As a former STPM candidate, I myself had lot of problems finding related web sites for STPM subjects.

iii. There are a lot of unnecessary features such as chat room, fashion links and other subjects of the teen's interest. This not a good aspect because they will be hooked to something other than studies which can be a waste of time and money. These sites should be only study orientated.

iv. Too massy. Too much information put in one page. For example at **Online Education Web**: http://www.eduweb.com.my. There will confusion in finding relevant information and to navigate the page.

v. These sites lack of real time or on line test and answers.

2.3.4 AREAS OF IMPROVEMENT IN PROPOSED SYSTEM

There isn't any online learning module, which are flawless. Every one of them has their strength and weaknesses. This will help me to design and develop a better system. The table below will describe the features of existing system and the proposed system, which will improve in comparison.

Existing system	Proposed system
1. A general site for all levels.	1. Made solely for STPM Levels
2. Features of teenagers interest.	2. Strictly a educational site.
3. Too massy and congested.	3. Will be broken up into few modules.
4. Lack of proper assessment.	4. A real-time test and answer will be added.

Besides the major improvements there are also some minor ones. They are:

- More improvements in multimedia aspects within the limitation of developing a professional site not a entertainment one.
- Inclusion of new technologies such as VRML.
- Other aspects follow the project objectives and scope.

2.4 SURVEY ON DEVELOPMENT TOOLS

A survey on development tool was conducted to develop the system. Set of suitable tools was chosen from the help of the Internet and books. Here I focus on software and programming languages. They are:

i. Web authoring tools.

ii. Programming and scripting languages.

iii. Graphics tools.

iv. Web server.

v. Database. (DBMS)

2.4.1 WEB AUTHORING TOOLS.

i Macromedia Dreamweaver MX

Dreamweaver is a popular Web authoring package, which combines visual page editing with HTML source code control. Its support for "Rountrip" editing means that developers can more precisely control the level of editing that is automatically applied to various areas of the HTML coding without endangering existing code and content. Roundtrip editing can be applied to HTML, XML, and server-side code such as ASP, JSP, CFML, and PHP. In addition, users can customize the Dreamweaver interface and instruct it to ignore any tag structure that the user needs to define.

Additional Dreamweaver features include site management tools, such as a built-in visual site map, global search and replace, FTP, and site synchronization options; a JavaScript code library and API for the automation of common cross-browser JavaScript effects; and a client side JavaScript debugging tool [3].

The latest release of Dreamweaver, dubbed Dreamweaver MX, combines the functionality of several separately available products into the Dreamweaver package. In addition to the original visual layout and editing engine, Dreamweaver now includes the functionality from the package formerly known (and no longer available separately) as Dreamweaver UltraDev (for server-side application editing, such as ASP, JSP, or ColdFusion), and additionally supports HTML code editing based on HomeSite technology (though HomeSite 5 will continue to be available as a separate product). Other key highlights of Dreamweaver MX include:

- A new workspace, integrated with the new Fireworks MX and Flash MX, featuring panel docking, file browsing, and tabbed windows
- Added server-side development support for ASP.NET, ColdFusion MX, and PHP
- Support for import, edit, and validation of XML Schemas; XHTML output and HTML to XHTML conversion
- Multiple tools optimized for ColdFusion MX developers; including wizards and reference information, integrated debugging, and Web services support.

ii. Microsoft FrontPage 2000.

FrontPage 2000 is the latest version of Microsoft's Web site creation and management tool. It features a new integrated Editor and Explorer and seamless integration with the Microsoft Office 2000 suite of products. Says Andy Schulert, general manager of the FrontPage product unit at Microsoft, "FrontPage delivers...with a unique combination of WYSIWYG and raw HTML editing, robust Web collaboration support and hundreds of feature improvements."

FrontPage 2000 improves on previous releases of the product by focusing on the developer's need to have complete control over the content and layout of their Web pages. New HTML and ASP preservation features mean that you can edit or import existing HTML pages without FrontPage changing your existing code. Multiple editing views give developers a choice of straight WYSIWYG development, a WYSIWYG mode that will also show HTML tags as floating yellow icons, or HTML mode which allows one to edit the HTML source directly in a personalized (color coding, indenting, etc.) environment.

Other page creation features include automatic generation of cross-browser DHTML and a browser selection option that will target your resulting pages to specific browsers and versions and automatically restrict functions not available to that platform. And, with its tight integration with the Office 2000 suite, developers can add database functionality to their pages with only a few clicks.

iii. Microsoft Visual InterDev

Previously codenamed "Internet Studio," Microsoft Visual InterDev is a powerful web application development system. It enables developers to build dynamic, database-driven web applications.

Microsoft Visual InterDev includes an integrated visual development environment, database tools, and site management and content editing tools. It enables developers to work with any database that supports ODBC, delivering HTML-based web applications that are browser and platform-independent [4].

2.4.2 PROGRAMMING AND SCRIPTING LANGUAGES

This review will assist in choosing the best type of scripting used.

SERVER SIDE SCRIPTING

The server-side scripting is used to run code on the server and to determine the HTML the clients sees. Server-side scripts can be used to make dynamic web sites, with different clients seeing different pages, depending on any number of variables. These variables can be described in a database according to username [4].

i. Active Server Pages (ASP)

ASP can be written in VBScript that uses syntax similar to Visual Basics, JScript, which is syntactically similar to JavaScript, Perl and Python. Asp-driven web site can be easily maintained. ASP most distinguishing benefit is its ability to use COM objects. As with everything else in ASP, using COM objects is incredibly easy. There are benefits from using COM objects. Firstly , users can use the same robust COM objects that are used in Visual Basics or Visual C++ on the ASP pages. Secondly, users can create Com objects for use on the ASP pages [5]. ASP pages require a Personal Web Server (PWS), or IIS, Microsofts Web server.

HTML vs ASP

Firstly, while ASP is different from HTML, it is usually written as scripts within an HTML document. HTML is a static document that the Web server displays upon request by the browser. But if the HTML has ASP scripts embedded within it, the server will run those scripts and then display the results within the page on the browser.

ASP vs JavaScript

So, it sounds like ASP is more like JavaScript than HTML. However, JavaScript is run in the Web browser itself rather than on the server side. This gives you all the processing power of the Web server to back up your scripts. Plus, because it is run separately from the browser, it can interact with other server-side technology such as databases, unlike JavaScript.

ASP vs CGI

In some ways, ASP and CGI are similar. You can use CGI to access databases and create dynamic, interactive, personalized pages. CGI programs run on the Web server rather than in the browser. But CGI uses an external program to do the work, which means that there is an additional layer on your Web server, which can cause more load and slow pages down.

ii. Visual Basic Script

Visual Basic Script is an Internet scripting language based on Microsoft's Visual Basic. It is a fast, cross-platform subset of Visual Basic, designed to create active, online content on the World Wide Web. It is being licensed at no cost to application, browser and tool vendors.

Visual Basic Script allows developers to link and automate a wide range of objects in web pages, including OLE objects and Java applets **[6].**

OTHER PROGRAMMING LANGUAGES

i. HTML

Hyper-Text Mark-up Language is the language used to specify the construction of Web pages. Web pages are a form of Hyper Text and include text, graphics and links to other HTML documents.

Web pages are stored as standard ASCII (American Standard Code for Information Interchange) files. Web pages may be viewed by a variety of different Web browsing tools, each of which may have different abilities. However, since Web pages are text files, each Web browser can read it and format the document in accordance with its abilities **[3].**

ii. JavaScript

JavaScript is a general-purpose programming language designed to let programmers control the behavior of software objects. The language is used most widely today in Web browsers whose software objects represent a variety of HTML elements in a document and the document itself. But the language can be and is used with other kinds of objects in other environments. For example, Adobe Acrobat Forms uses JavaScript as its underlying scripting language to glue together objects that are unique to the forms generated by Adobe Acrobat. Therefore, it is important to distinguish JavaScript, the language, from the objects it can communicate with in any particular environment. When used for Web documents, the scripts go directly inside the HTML documents and are downloaded to the browser with the rest of the HTML tags and content [9].

2.4.3 GRAPHICS TOOLS

i. VRML.

VRML, sometimes pronounced *vermal*, is an acronym for the Virtual Reality Modeling Language. Technically speaking, VRML is neither *virtual reality* nor a *modeling language*. Virtual reality typically implies an immersive 3D experience (such as a head-mounted display) and 3D input devices (such as digital gloves). VRML neither requires nor precludes immersion. Furthermore, a true modeling language would contain much richer geometric modeling primitives and mechanisms. VRML provides a bare minimum of geometric modeling features and contains numerous features far beyond the scope of a modeling language.

VRML is simply a 3D interchange format. It defines most of the commonly used semantics found in today's 3D applications such as hierarchical transformations, light sources, viewpoints, geometry, animation, fog, material properties, and texture mapping. One of the primary goals in designing VRML was to ensure that it at least succeeded as an effective 3D file interchange format. VRML provides the technology that integrates three dimensions, two dimensions, text, and multimedia into a coherent model. When these media types are combined with scripting languages and Internet capabilities, an entirely new genre of interactive applications are possible. [7].

ii. VRML BROWSER

Cortona VRML Client

This is a plug-in or player to visualize VRML scenes. It must be installed in the computer. It is developed by Parallel Graphics Inc and can be downloaded at their site. Below are the strengths of this add-on [8].

Highly optimized for complex VRML rendering, performance and ease of use. It is also the smallest and fastest available plug-in.

It includes VRML97 support including JavaScript language support.

It supports NURBS, Spline and keyboard sensors.

Other supports are RealVideo and RealAudio, Macromedia Flash Animation, drag and drop support, External Authoring Interface and supports ActiveX.

iii. VRML File Creator for Chemical Structures

All the chemical structures which will be used in the system are generated at this web site: http://www2.ccc.uni-erlangen.de/services/vrmlcreator.

iv. Adobe Photoshop

As the industry standard for digital image manipulation software, Adobe Photoshop has revolutionized the photography and prepress industries and has provided commercial and fine artists with an exciting new medium for photographic editing. Adobe has integrated into Photoshop a design based upon traditional photo manipulation technique, where tools and processes directly correspond with those used in 'physical' photography. Photoshop introduces features and enhancements which go far beyond the capabilities of the darkroom technician, thanks to digital technology; yet through an interface based on traditional technique, it is certain that one should easily adapt to the program environment.

2.4.4 DATABASE

i. Microsoft Access 2000

Access is a database platform, which makes it possible to develop database-integrated ASP web sites. Because all the information in an Access database is contained in a single file, it is easy to upload or download the entire database over FTP or the web.

Access allows the user to link together data stored in more than one file. It stores information in an easily retrievable form. It can store information such as text, numbers, dates, currency, pictures, and sounds. As well as being able to store data, it allows information to be selected easily and quickly. The summaries of the information selected can also be printed.

ii. ODBC

Open database Connectivity (ODBC) is a standard devised by Microsoft to enable any application to communicate with any database manager. The standard is based on the work of the SQL-Access Group, a group of interested hardware, software and networking vendors, who defined a common database access method to simplify client/server computing. A key objective of this group was to define an SQL syntax which could be common to all database engines. Microsoft has taken the core set of the

Group's output and developed a call-level interface which it has called Open Database Connectivity (ODBC). Most key database server vendors and the suppliers of many desktop products now provide an ODBC interface, via which the end-user has access to centrally stored data directly from the desktop products. With the leverage Microsoft currently has on the market place, ODBC now dominates client/server database connectivity.

2.5 ONLINE LEARNING RELATED CONCEPTS AND ISSUES

2.5.1 COMPUTER AIDED INSTRUCTION (CAI)

Computer Aided Instruction is web-based or computer-based tools to assist regular instruction. The reason I chose this issue are below **[10]**

- Will help me to decide whether is it worth to develop an online course delivery module. This will be judged from the advantages and disadvantages that will be listed in the table.
- To pinpoint the areas of improvement in my proposed system.

Advantages of CAI

i. Improved learning.

ii. Increased learner centeredness.

iii. Geographic and temporal independence.

iv. Scheduling flexibility.

v. Multiple modes of learning used.

vi. Inexpensive communication tools.

Disadvantages of CAI

i. Limited interaction between learners.

ii. Low speed connection and computer virus threats.

2.5.2 VIRTUAL REALITY MODELING LANGUAGE (VRML) IN CHEMISTRY

The number of chemistry-related World-Wide Web sites has grown from a few hundred since our introductory review in 1995 to around 3600 by early 1998. Much of the chemical content of these sites has been expressed using Hypertext-markup language (HTML), incorporating hyperlinks in the form of the now familiar URL (Uniform Resource Locator) to create associations with other documents and sites, and to reference visual content such as two-dimensional images, diagrams and schemes. Since 1994 however, a number of novel technologies have been introduced to the Web, which go beyond the use of simple images. Here we will focus on one such method termed Virtual Reality Modeling Language or VRML, which has been applied in a number of chemically interesting ways [8].

i. The limitations of Images

The basic object collection used to construct a document in HTML is the **ASCII** character set which includes the letters you are reading now, together with some specially reserved control characters such as < or >. Together with some Greek symbols (which are actually not handled well in HTML), highly complex chemical meanings, semantics and data can be expressed. Chemistry however can be a particularly visual subject, and many of our models and data of molecular behavior and structure are most easily comprehended and disseminated using visual means of expression. On the Web, most visual illustrations have hitherto been derived from bit-mapped digital formats, or images as they are known. As devices for expressing chemical content and meaning,

such images offer little advantage over the use of print, and suffer from the same limitations such as the great difficulty in indexing of and searching for the meaning they carry. Another limitation (or advantage, depending on your point of view) is that such illustrations show only their author's interpretation and selected viewpoint of a particular chemical concept or expression of data and are subject to copyright control. The reader cannot select any other viewpoint or impose upon that viewpoint any other style, nor can they easily recover in an error-free manner any of the original data or information used to generate the illustration, or indeed copy the image without permission.

ii. The Importance of Models

We believe that a superior approach lies in defining multi-dimensional models wherever practicable, rather than in creating static 2D illustrations. Such models could if needed have attributes of time-dependence (*i.e.* animation), sounds and behavior controlled by specified algorithms. Virtual reality modeling language (VRML) was born at a workshop at the first World-Wide Web conference held in Geneva in May 1994 as an expression of this need, and even then chemical applications were envisaged. The first definitions of this new framework emerged in October 1994 and became standardized as version 1 during 1995. This was superceded by VRML 2 in 1996, and has now been renamed VRML 97. It is worth emphasizing that VRML was designed as a generic modeling language, in contrast to HTML, which is a markup language. Markup is a mechanism, which allows the author to express semantics, and can thus be used to provide fine-grained structure and relationships in a document. Such internal structure in turn allows indexing of the content. VRML, as a modeling language, is currently less suited for semantic expression, and hence for operations such as indexing.

To illustrate the difference between a modeling and a markup language, consider how an atom might be described. HTML itself has no well defined mechanism for defining an atom, and one has to use a markup language such as CML (Chemical Markup Language, which is an implementation of XML, itself an evolutionary successor to HTML) to define an atom and properties such as atomic number, its connectivity to other atoms, the number of electrons associated with it and so forth. Using VRML, one would define the same atom as an spherical object, with model properties such as color, radius, 3D co-ordinates, lighting and motion attributes, and if necessary associate this object with scriptable actions such as collision avoidance with other objects (computed if necessary using e.g. molecular mechanics force fields). VRML is therefore complementary to a markup language since it defines a quite different set of primitive and importantly three-dimensional objects, which can be used to express complex chemical models in a visual manner. Copyright implications for models are also different from illustrations, in part because models are specified using data provided by their author, and only created in a specific viewable style by the actions of the reader and the software they are using.

3.0 DEVELOPMENT METHODOLOGY

3.1 ROLE OF DEVELOPMENT METHODOLOGY

A methodology is a systematic way of accomplishing certain tasks and maybe defined as a collection of procedures, techniques, tools and documentation aids. The procedures, techniques, tools and documentation aids help the software developer to speed up and simplify the software development process [11].

A methodology encompasses the methods used within the methodology. Different methodologies can support work in different phases of the system life cycle, for example, planning, analysis, design and programming, testing, and implementation.

The objectives of a methodology include [11]:

i. Records accurately the requirements for the system.

ii. Provides a systematic method of development so that progress can be monitored.

iii. Produces a system that is well documented and easy to maintain.

iv. Provides an indication of needed changes as early as possible in the development process.

v. Provides a system that is user friendly.

3.2 SYSTEM DEVELOPMENT STRATEGY

The development strategy for this system is based on the waterfall model. First I will give the historical background of this model and later explain what it is in detail. Then it will be compared with other similar models, explain its strengths and weaknesses and lastly explain why I have chosen this approach.

At first programming software was simple and often done by one person and for engineer or scientific purposes. However, as the use of computers got more widespread, software had to be written for other people than the writers themselves, people with little or no understanding in programming. The old idea of writing a program and then fixing the bugs was no longer sufficient. In 1970 Royce proposed a model for the development of software, derived from a similar model from engineering activities. The notion at the time was that software development was an engineering discipline and that, therefore it would follow a model. This model was warmly greeted and became known as the waterfall model. Later it was found that it only worked well for certain classes of software and new, more complex models were developed. The original model by Royce was also slightly improved and adjusted over time**[12]**.

The waterfall model, as stated in the introduction, is an engineering model designed to be applied to the development of software. The idea is the following: there are different stages to the development and the outputs of the first stage "flow" into the second stage and these outputs "flow" into the third stage and so on.

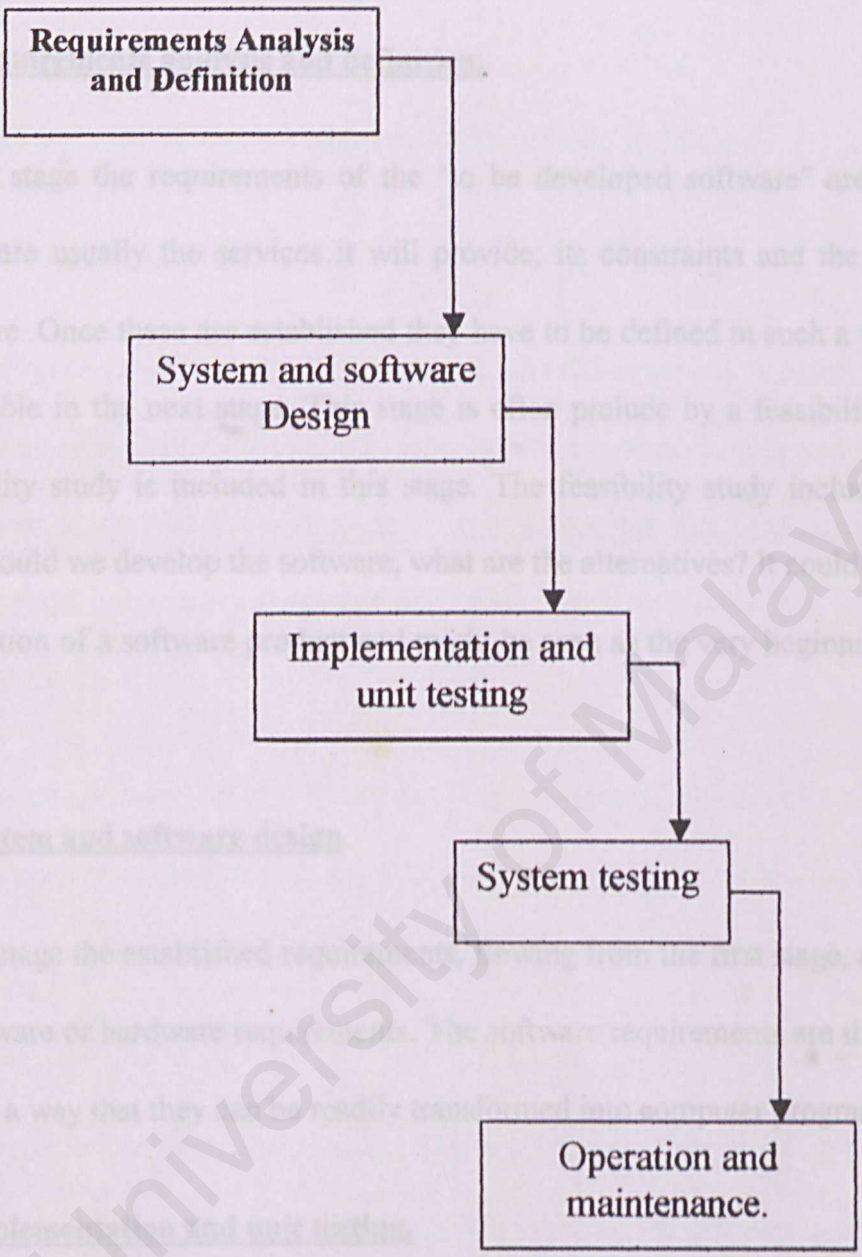

Figure 3: Waterfall model

There are usually five stages in this model of software development:

1. **Requirements analysis and definition.**

In this stage the requirements of the "to be developed software" are established. These are usually the services it will provide, its constraints and the goals of the software. Once these are established they have to be defined in such a way that they are usable in the next stage. This stage is often prelude by a feasibility study or a feasibility study is included in this stage. The feasibility study includes questions like: should we develop the software, what are the alternatives? It could be called the conception of a software product and might be seen as the very beginning of the life cycle.

2. **System and software design**.

In this stage the established requirements, flowing from the first stage, are identified as software or hardware requirements. The software requirements are then translated in such a way that they can be readily transformed into computer programs.

3. **Implementation and unit testing.**

This is the stage where the computer programs are created. Each program is called a unit, and unit testing is the verification that every unit meets its specification.

4. **System testing.**

All the units are combined and now the whole is tested. When the combined programs are successfully tested the software product is finished.

5. **Operation and maintenance.**

Most software products include this stage of the development. It involves correcting errors that have gone undetected before, improvement and other forms of support. This stage is part of the life cycle of a software product, and not of the strict development, although improvements and fixes can still be considered as "development".

These steps are the main stages. There are also sub-stages, within each stage, but they differ from project to project. For example for management purposes the requirements stage is divided in a feasibility study, an outline requirements definition, a design study and a requirements specification stage.

It is also possible that certain software projects require the adding of an extra stage all together, or the splitting of one in two stages. However all the different waterfall models have the same underlying idea; the idea that one stage provides outputs which can be used as the input for the next stage. There thus is a linear flow amongst the stages. The progress of the software development, using the waterfall model, is thus easy to find out. A common way to look at the outputs of a certain stage and see whether or not they are finished in time, thus seeing how far the overall progress is.

There are also activities which are performed at every stage of the software development. These are documentation, verification and management. Documentation is intrinsic to the Waterfall model for it is document driven, as most of the outputs are documents. Verification, not only is a part of implementation & unit testing and system testing, but it is also part of all the other stages in the form of walk troughs, reviews and the like. Management involves the tailoring of the waterfall model to fit individual processes, managing the human resources (i.e. the people) and managing the rules and the protocol on how the output is formalized, who accesses what and other managing tasks.

Finally it has to be noted that the software development process is not as linear as it seems. When errors in later stages are found, they are often fed back to a previous stage and the development is set back to that stage again. Since this is a managing nightmare, it often occurs that problems are ignored, left for later or programmed around. This feed back makes for a waterfall with information flowing both ways: down through the stages when something is made, and up through the stages when something goes wrong, or feedback is given. Also many processes are frozen when it is not yet the time to deal with them. This has led to the development of other, more flexible models.

3.2.1 STRENGHTS AND WEAKNESSES OF WATERFALL MODEL

STRENGHTS:

1. It flows well and is easy to understand from a broad viewpoint.
2. It is easy to implement.
3. Flaws are easy to find as they are flushed out as every stage.
4. Product is well documented.
5. High visibility.
6. Well known and well used.
7. More predictable application development project.
8. Greater chances of project delivery on time and within budget.

WEAKNESSES

1. Design cost is increased every stage. The later a problem is found, the more it cost.
2. Working product is not available for viewing until the finished product. The user must wait until the end to see any product and if the product fails, it signals process failure.
3. Too much time taken for development to be able to get on with product.
4. Often difficult, to get design requirement at the beginning, especially from user.

Other Models.

There are several other models that arose from the fact that the waterfall model is not always best suited for every project. They will be discussed, in short, here.

1. **Code and Fix model.**

This is not really a model as such. It is the original approach as how to develop software when software development was still done by one person and for a restricted public who were themselves able to develop software.

2. **Exploratory programming.**

In this model the idea is to develop a working model as quickly as possible which is then modified until it does what it's supposed to do. Exploratory programming is best suited for systems where it is very difficult to establish detailed system specifications. This is mostly used to develop AI systems. It requires the use of very high programming languages. Validation here does not exist and rather the programs, which are created, are checked for adequacy. This model has been little used in software development other than in AI. This is because the management techniques that currently exist are not adequate to manage this model, and the programs resulting from this tend not to be well structured. However since there are no clear specifications in developing AI systems, which imitates human behaviors, other models, including the Waterfall model are not adequate to handle this type of problems.

3. **Evolutionary Model, or Prototyping.**

Like in exploratory programming the idea is to create a program as quickly as possible. This program is known as the throwaway prototype. This prototype is used to give the software engineer a way to find out what the exact requirements are. Then a second program is written using the waterfall model. Evolutionary prototyping consists of many such steps and is the same as exploratory programming. In the evolutionary model a program is build once and the program is gradually improved, and thus it is increment driven; unlike the Waterfall model which is document driven.

4. **Transformation model, or Formal transformations.**

In this model, informal requirements are analyzed which are then formalized using formal methods. This may take several steps. Once the requirements are entirely formalized they are translated into a program. The fact that the formalization takes several steps makes it support program evolution, so that later changes are easier to make than with the Waterfall model. When an update or change has to be made, due to the formal nature of the process, you often don't need to go all the way back to beginning. In the Waterfall model you don't have to go back to the beginning either, but that results in some dodgy coding.

5. **Spiral model.**

The spiral model is a metamodel, for it can incorporate any other model in it. Whether one or the other model is chosen depends on the level of risk. The spiral model focuses on parts of the software development that are more problematic, or have a higher risk factor, than others. Another important factor is that the model is non-linear. The model consists of four stages, which are continually passed through. They are a stage to plan the next stages and what model will be used in that cycle, a stage that deals with determining the objectives, alternatives and constraints, a stage to evaluate the alternatives, identify and resolve the risks and a stage to develop, verify a product. Every cycle of stages can be done with a different model, according to what is best. Also forgotten things can be included far easily than in the waterfall model.

CONCLUSION.

Even there are some weaknesses in waterfall model; I find that the advantages outweigh them. For example unlike the prototyping model, the waterfall model has a clear step-by-step phase where each phase is required to be completed almost flawlessly before proceeding to the next phase. The prototyping method is more of a trial and error process. To me, this method wastes time and cost.

Some people might like to experiment with latest techniques; I on the other hand prefer to have clear and well-defined steps to follow to ensure a high quality and error-free product as the deliverable in the end.

3.3 DEVELOPMENT TECHNIQUES

i. DATA FLOW DIAGRAMM (DFD)

This is a method to conceptualize how data moves through the system, the processes and transformation that the data undergoes and what the outputs are through a graphical representation. DFD is easy to use and understand. It also enables a better understanding of relationship between system and their subsystems **[13].** The DFD for the proposed system will be shown in System Design in chapter 4.

ii. PROJECT SCHEDULING: Gantt chart

Since this project has time restrictions, I to make schedule had all the tasks involved. The best way I found was by using Gantt Chart. It is an easy way to schedule tasks. I is essentially a chart on which bars represent each task or activity. The length of each bar represents the relative length of the task. This method also can represent the characteristics such as complete activity and incomplete activity. Using different types of colors or symbols on the chart can do this.

4.0 SYSTEM ANALYSIS AND DESIGN

4.1 SYSTEM ANALYSIS

4.1.1 ROLE OF SYSTEM ANALYSIS

System analysis is the study of a single information system application. System analysis seeks a general understanding of the solution that would be required to solve the problem or exploit the opportunity identified in system investigation. It considered what existing (if any) does to solve the problem, considered alternative solutions to the feasibility and implications of these solutions. In short, system analysis attempts to answer the question " what must the information system do to solve the problem? ". The primary deliverable system analysis is a list of system requirements and priorities. **[14]**

Objectives of this analysis phase are:

i. Research on how this proposed system can be developed using current or maybe latest emerging technology. (Tools to develop the new system will be chosen among different types of new tools that have been studied and stated in Literature Review.)
ii. To gain overall understanding of the proposed system through data flow and system process. (will be shown in System design)

iii. To identify the major components to be included in the proposed system. (To identify what are the modules that are feasible to develop and the knowledge and tools to have in order develop them.)

iv. To identify the software and the hardware requirement to develop the proposed system.

v. To analyze and plan control features to develop a robust and reliable system.

The areas covered for System Analysis in this report are stated below.

- Requirements Analysis
- Technical Requirements

4.1.2 REQUIREMENTS ANALYSIS

4.1.2.1 FUNCTIONAL REQUIREMENTS.

Functional system requirements are system services, which are expected by the user of the system.

i. Searching module.

Enables users to search for information through the proposed web site with ease. The features are:

a) Keyword Search

This function allows users to type in keywords of information needed. It will help users to find information such as definition of chemistry terms.

b) Browsing.

Information can be obtained through browsing within the site.

ii. Interface

User-friendly and attractive user interface is important. The features in the interface must also be easy to understand. And appropriate to the intended target user.

iii. Multimedia features

Multimedia features attract more users. The multimedia features must have a short downloading time and must be able to complement the information given.

a) Text

Textual information is used here because it is an informational site.

b) Graphics and Animation

Graphics and animation have values that enable users to understand better.

iv. Interactive Modules

These modules allow users to give feedback and enable to have interactive experience using the web.

v. Navigational Tools

Navigation procedures with minimum delay between pages should allow users to navigate to any part of the system without having to proceed through too many steps.

4.1.2.2 NON-FUNCTIONAL REQUIREMENTS

Non-functional requirements set out the constraints under which the system must operate and the standards, which must be met by the delivered system.

i. User-friendly

This will enable users to use the system with ease. This includes building in clear and simple controls that allow understandability of the functions that can be carried out. Consistency of the interface design throughout the system reduces confusion during usage. The features should enable easy retrieval of information.

ii. Security

Security of the system must be well kept and managed. Logins and passwords can help implement security of the system.

iii. Fast response time

Fast response time such as, fast interaction time and quick download is needed to ensure user attention span. Slow response time will be an annoyance to users. Hence, use of plug-ins and graphics and graphics images with large size will be minimized.

iv. Reliable and efficient performance

Coding should be free of bugs and the overall performance should be reliable. Warning messages should be incorporated, before downloads and, wherever, deemed necessary.

4.1.3 TECHNICAL REQUIREMENTS

This section comprises the programming scripting requirements, software requirements and hardware requirements.

4.1.3.1 SCRIPTING REQUIREMENTS

Here are the list of programming languages which will be used to develop the system.

i. Hypertext Markup Language (**HTML**).

ii. Java Script.

iii. VB Script.

iv. Active Server Pages (**ASP**)

v. Virtual Reality Markup Language (**VRML**)

4.1.3.2 SOFTWARE REQUIREMENTS

The software required for building this website are:

i. Windows 98 operating system.

ii. Microsoft Personal Web Server.

iii. Microsoft FrontPage 2000

iv. Macromedia Dreamweaver 4.0 (MX)

v. Internet Explorer 5.

vi. Adobe Photoshop 5.0

vii. Macromedia Flash.

viii. Microsoft Visual InterDev.

ix. Microsoft Access 2000.

x. Cortona VRML Client.

4.1.3.3 HARDWARE REQUIREMENTS

Hardware required for running this system are:

i. Intel Pentium or AMD processor based system.

ii. Minimum 50MB hard disk space.

iii. At least 32MB RAM.

iv. Mouse, keyboard, modem, network card(optional) and etc.

obtain from the analysis method are put as an input in this phase. The functional specifications were diagramed using graphical notation such as data flow diagrams and data dictionary tables. The representations allow the system to be viewed at an abstract level. The database of the required system also carried out. The databases are used to store data, allow editing of data, and to provide for data retrieval. The data flow diagram (DFD) was used to map the requirements specified by both users and the system. It represents the system in different level of abstraction, which isolate different focuses. This was eventually used in the development stages.

The system design for the proposed system divided into stages.

- Architectural Design.
- Database Design.
- System Process Design
- User interface Design.

4.2.1 ARCHITECTURAL DESIGN

The primary objective here is to develop a modular program structure and represent the control relationship between modules. In addition, architectural design melds program structure and data structure defining interfaces that enable data flow

throughout the diagram. My proposed systems architectural design are divided into two modes. They are administrator module and the user module.

i. Administrator module

Information and designs are updated time to time. There is also a login password to access the data in the databases.

ii. User module

This mode will identify functions for the users, which are retrieving information from databases, browsing method, the keyword search method and the navigational method.

4.2.2 DATABASE DESIGN

The data design transforms the information domain model created during analysis into the data structures that will be required to implement the software.

The database will be built using Microsoft Access2000. The database is then linked to the web pages to store data, allow editing if data and to provide data retrieval.

Since this is the designing stages and the system is yet to be developed, I show one example of one table of the process. The process is keyword search.

Table structure of keyword search

Field Name	Field Type	Field Size	Description
KeywordID	AutoNumber	Long Integer	Identification of the keyword
TableID	Text	50	Location of information
ID	Integer	Long Integer	Identification of information
Keyword	Memo	64 000	Keywords related to the information

Table 4

All the other tables associated to the database will shown after the system has been developed.

4.2.3 SYSTEM PROCESS DESIGN

System process design are pictorial representations that denote the systems functionality and modular structures

Data Flow Diagram

Data Flow Diagram (DFD) is the description how data flows from one logical processing unit to another. The DFD is already explained in Methodology in chapter 3. A context diagram of the system will be shown in this chapter.

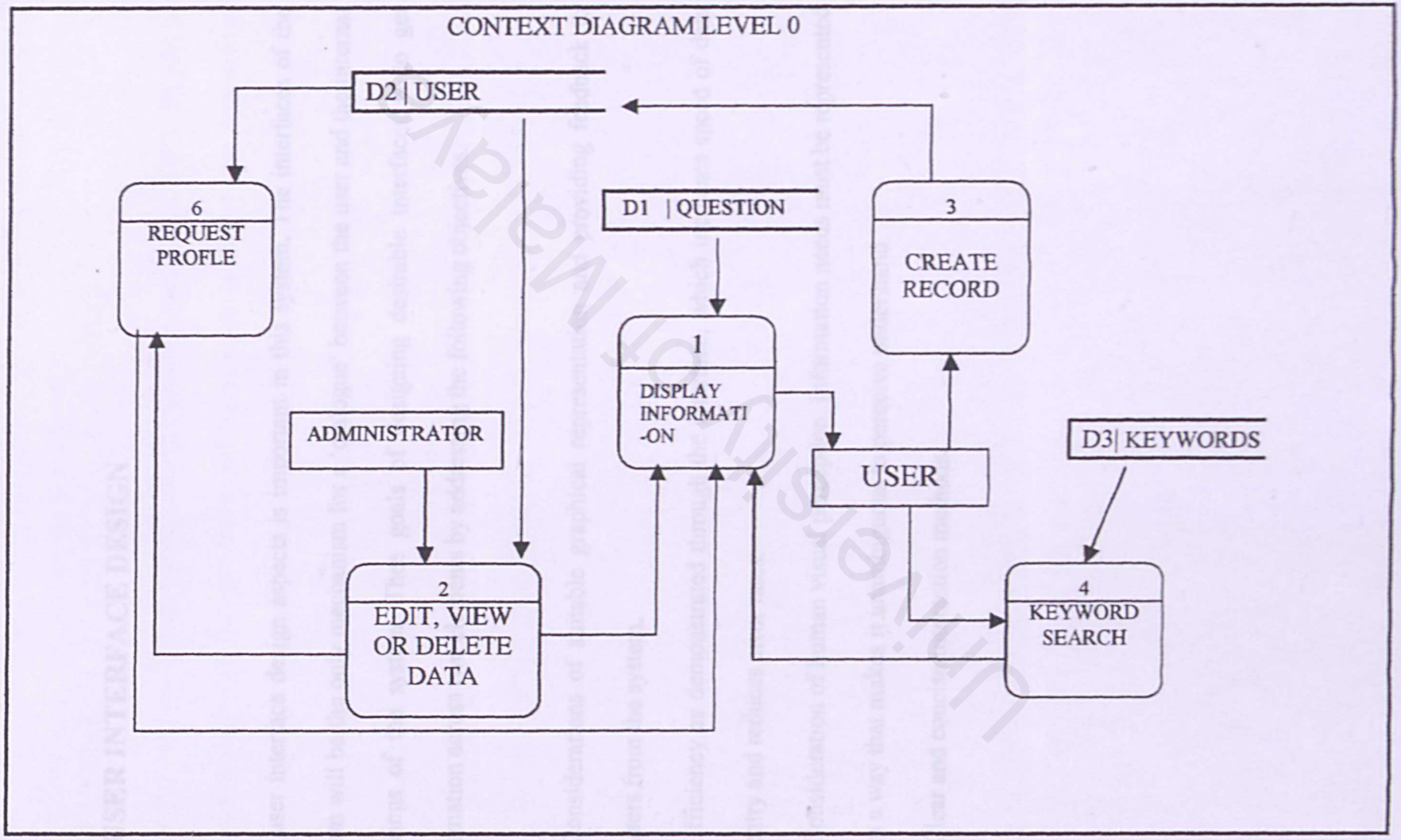

Figure 4: Context diagram level 0

4.2.4 USER INTERFACE DESIGN

The user interface design aspects is important in this system. The interfaces of the system will be the only mechanism for a 'dialogue' between the user and the internal workings of the system. Thee goals of designing desirable interfaces is to get information across two elements by addressing the following objectives.

- Considerations of suitable graphical representation and providing feedback to users from the system.
- Efficiency as demonstrated through the interface, which increases speed of data entry and reduces error rates.
- Consideration of human visual perception. Information needs must be represented in a way that makes it unambiguous to perceive understand.
- Clear and concise interaction methods.

4.2.3 STATEMENT OF EXPECTED OUTCOME

The expected outcome of this online learning module is that it will fulfill the project scope and it will have all the specified requirements stated in this chapter. It will have information targeted for STPM students with interactive and multimedia features. It will include all the modules stated in the project scope and have suitable user interfaces as stated in System Design.

5.0 SYSTEM IMPLEMENTATION

5.1 Introduction

System implementation is a phase involves coding, debugging and testing. During this phase, the designed modules and function of the system are transformed into workable system based on given requirements

5.2 Development Environment

5.2.1 Software Development Tools

Software development tools to develop the system are mentioned earlier on technical requirements in System Analysis chapter. After the research done in that chapter same tools were used to develop the system.

The software required for building this website are:

i. Windows 98 operating system.

ii. Microsoft Personal Web Server.

iii. Microsoft FrontPage 2000

iv. Macromedia Dreamweaver 4.0 (MX)

v. Internet Explorer 5.

vi. Adobe Photoshop 5.0

vii. Macromedia Flash.

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ix. Microsoft Access 2000.

x. Cortona VRML Client.

5.2.2 Hardware Requirements

Hardware to develop the system are mentioned earlier on technical requirements in System Analysis chapter.

Hardware required for running this system are:

i. Intel Pentium or AMD processor based system.

ii. Minimum 50MB hard disk space.

iii. At least 32MB RAM.

iv. Mouse, keyboard, modem, network card(optional) and etc.

5.3 System Coding

5.3.1 Coding Methodology

Bottom up approach, which starts coding at lower level modules before higher-level modules, was used to develop this system. The system is divided into two major modules where each one will have its own sub modules. Each sub modules is developed one by one for correctness before proceeding to higher-level modules. Later, the main and sub modules were integrated to ensure functionality.

5.3.2 Coding Approach

i) Connecting to database

Before one can connect pages to the database, a connection has to be defined. A connection file is what links the database to the page itself. The first step in the attempt to link the system to the database. This happens with this file:

```
Set conn = CreateObject("ADODB.Connection")
conn.open "DSN=Database"
```

Include File

The coding above is repeated in many ASP pages. Using include eliminates repeating the code in every ASP page and ease the work of correcting ASP Page when a change is done. Just include the following code in the header of the ASP page.

```
<!---#include file="inc/ado.inc"--->
```

ii) Coding to Select, Insert or Delete Data

After connecting to database, data in the tables can be retrieved; deleted or new data can be inserted to the table.

SELECT statement is usually used when a particular record that matches a condition is needed. Example code to obtain users Ic number from User Info table and store it

```
mySQL = "SELECT * FROM User_Info WHERE user_id = " & user_id
```

New data or record is added to the user login table according to its field

```
mySQL = "INSERT into UserLogin"
mySQL = mySQL & "(User1_ic,password,UserName)"
```

Existing data can be deleted using DELETE statement. The syntax below deletes user id eventually deletes the whole row in the table

```
mySQL = "DELETE * FROM user_info WHERE user_id = " & user_id
```

iii) Coding to get results from the form

Method request() is used to extract data from the form submitted whenever users clicks submit button. Code below captures input user_name from another form and assigns as Name1.

```
Name1 =trim(request("user_name"))
```

iv) Coding on query string and getting its value

Query string passes a variable and its value to desired destination. Example:

```
strSQL = strSQL & Request.QueryString("search") & "%';"
```

5.4 Database Implementation

Since my system uses database to store information. In order to do that I organized the work. After collecting the relevant input types, I created entities to represent each information. For example for registration the input data were name, Ic number, address, password and so on. Next I set data type for each field, for example integer for age and characters for name. Later all these information were put into tables in Microsoft Access and the primary key was set. The same process was done for other tables too.

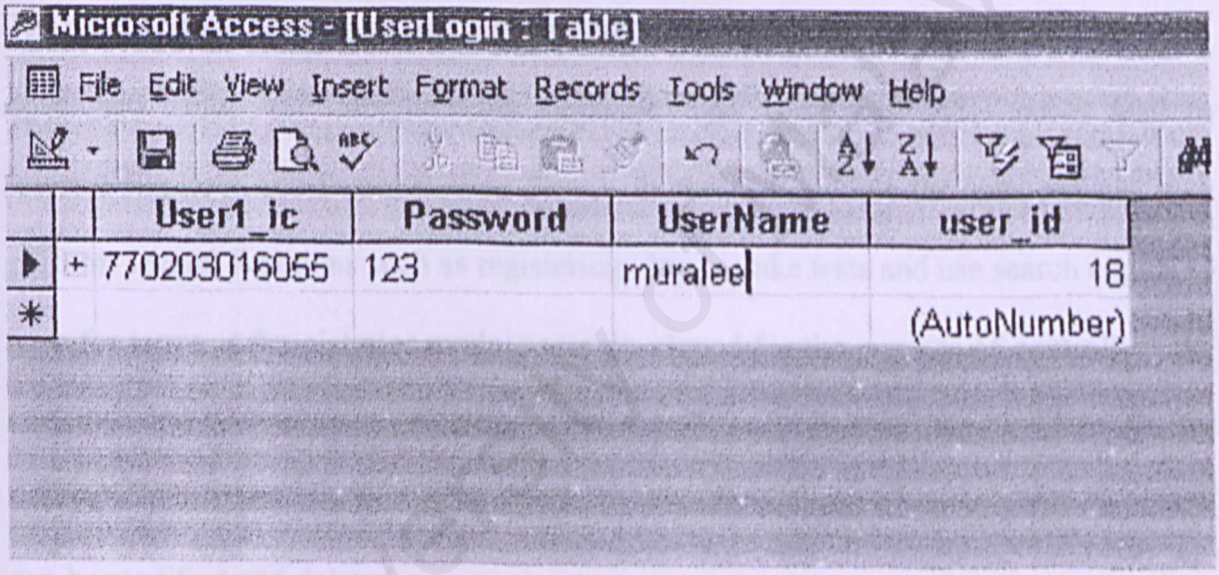

Figure 5.1: Table for user login

5.5 Module Implementation

Module Implementation is a process to flowchart of design to become system executable software. It translates the design scratch of each module into coding using appropriate programming languages. The flow of system is translated into coding by ASP scripting language. The front end of each module are recorded by using HTML for static parts and ASP for dynamic part. The back-end is coded by ASP and VBScript. For processing such as connecting to database and data processing.

The development consists of two main modules that the user and administrator. Both are developed using ASP programming language. This is because ASP works well in Internet Explorer and Personal Web Server. In the user module the user can use it to perform several functions such as registering , log-in, take tests and use search engine to look for terms. Administrator module was developed for the purpose of controlling the system to ensure it functions properly. Admin module also help to monitor users, discard users and to manage the records properly. This module displays user information which can be modified and deleted.

5.6 Interface Implementation

After implementation of each module, to design and arrange the information to be displayed. The purpose is to set up user-friendliness and efficiency for the users. It includes choice of background color, font size, error message, the arrangement of the data and the linking among each interface.

5.7 Security Implementation

The purpose of this step is to setup and to ensure that the provided data is private and confidential when it is transmitted over the Internet. It includes using authentication username/password to identify authorized users.

5.8 Process Integration

Any Internet user can access this system which resides in Windows 98, using web browser. Web page serves as an interface between the user and the system. When user sends a request to the system, the system will respond and complete the operation in the server before sending back the information to the client browser.

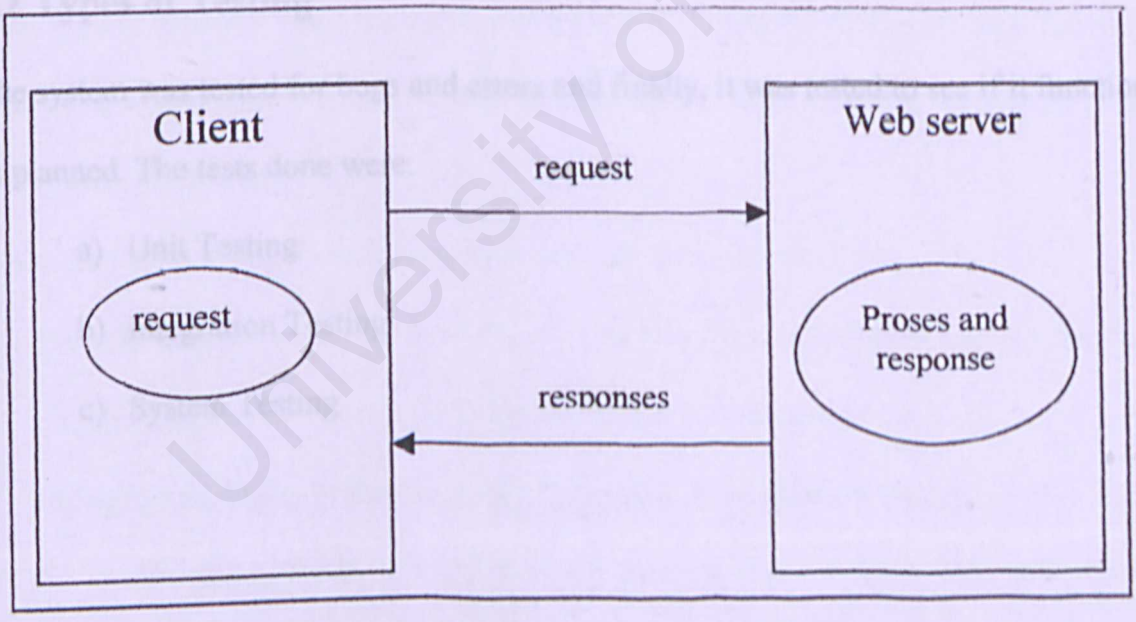

Figure 5.2: Process Integration Between Client and Server Side

Chapter 6: Testing

6.1 Introduction

Before my system was ready to be submitted, I had conducted a series of test. Since the waterfall model was chosen as the methodology, on one of the stages requires system to be tested in various way before delivering the product. Once code has been generated, the program testing stage begins. The testing focuses on both the logical internals of the software, ensuring that all the statements have been tested and on the functional externals, that is to track its errors.

6.2 Types of Testing

The system was tested for bugs and errors and finally, it was tested to see if it functioned as planned. The tests done were:

a) Unit Testing

b) Integration Testing

c) System Testing

6.2.1 Unit Testing

Unit testing is normally considered as the next stage after the coding step. After source level code has been developed, reviewed, and verified for correspondence to component-level design, unit testing begins. A review of design information provides guidance for establishing test cases that are likely to uncover errors in each of the categories discussed

earlier. Each test case is coupled with a set of expected results.

Because a component is not a stand-alone program, software, and/or stub, unit testing must be done on each individual component. Stubs serve to replace modules that are called by the component to be tested. A stub or dummy subprogram interface, only does minimal data manipulation, prints verification of entry, and returns control to the module undergoing testing.

Drivers and stubs are software that must be written but that is not delivered with the final software product. If drivers and stubs are kept simple, it would actually be easier and less time consuming to complete. Unfortunately, many components cannot be fully tested with simple software/pages. In such cases, complete testing can be postponed until the integration test step.

Unit testing is easier when a simple component is designed. When only one function is addressed by the component, a number of test cases is reduced and it is easier to identify errors and correct them.

In the unit testing stage, the following conditions were tested:

a) **Module Interface** is tested to assure that the flow of information is which runs through the program unit is done smoothly and without problems

b) **Independent Paths** in the program are tested at least once per path.

c) **Error Handling Paths** are tested to assure that the system is able to handle all expected and unexpected errors and will prompt out the appropriate error messages.

6.2.1.1 Unit Test (Edit Record)

The administrator can edit and delete records through the admin module. A unit test was conducted such as below.

Table 6.1 Unit Test Case for Edit Record

No	Test Procedure	Output	Test Result Analysis
1	Click on the edit link next to a particular record	Redirected to the edit record screen (User_edit.asp)	User details displayed
2	Enter new data to replace the old data. Click Edit button.	Data replaced and redirected to admin module (User_display.asp)	Details changed correctly and displayed.
3	Login with new details (login & password)	Successful, redirected depending on account type (user).	Changing details successful. Details replaced in the database.

6.2.2 Integration Testing

Integration testing is a systematic technique for constructing the program structure while at the same time conducting tests to uncover errors associated with interfacing. The objective is to take the unit tested components and build a program structure that has been dictated by design.

Integration testing is necessary due to the fact that data can be lost across an interface. One module may cause changes to another sub module when combined and may not

produce the desired major function. Therefore, causing the website not to work.

6.2.2.1 Integration Test (Login Page)

The E-Kuliah or the e-learning page is a secured page. The user need to login first. A test was conducted to make sure this function works well.

Table 6.2 Integration Test Case for Login Page

No	Test Procedure	Output	Test Result Analysis
1	Insert invalid username and/or password and click the submit link.	Error message displayed.	System cross checks records with the database and redirects to relevant page.
2	Insert valid username and/or password of the user type and click on the submit link.	Redirected to the main page (Tajuk.htm).	System cross checks records with the database and redirects to relevant page.

6.2.3 System Testing

The system testing phase is a phase where the system is run through a series of tests to see if the system can fully exercise its functions. This phase is very important as all elements in the system has to be verified and in proper working condition. All elements, once integrated have to be able to interconnect with each other without flaws and errors and the system must be able to perform the required functions.

System testing is usually done to ensure the system does what the customer wants it to do or rather what it was designed to do. The system must be tested with elements such as hardware, software end users and so on.

The steps in system testing include:

a) function testing

b) performance testing

c) acceptance testing

d) installation testing

6.2.3.1 Function Testing

A function test checks whether the integrated system performs its functions as specified in the requirements. The system was actually to be tested with real students. Due to time constraint, an informal test was conducted to test out the systems functionality. This informal testing was conducted with my friends. A briefing was done beforehand to explain about the system. The feedback give was quite satisfying.

6.2.3.2 Performance Testing

Performance testing is done to compare the integrated components with the nonfunctional system requirements. These requirements include security, accuracy, speed and reliability as these requirements constrain the way in which the system functions are performed. Below are the tests done:

- **Security test** done reveals that the system has sufficient security coverage although not absolute coverage. Certain parts of the site can only be accessed with a login and password and student records can only be accessed with a administrator login and password. Therefore, the system can only be accessed by valid users and altered by valid supervisors.
- **Accuracy and reliability tests** done revealed that the system meets its requirements. Although e-Kimia is a simple web page, records inserted and tests done displays the expected outcome without errors.
- **Speed tests** reveal that the response time for the system is satisfactory and fast enough. However, response time is dependant on the speed of the Internet connection and the amount of users on the system. There are no big files on the system and therefore, download time is also satisfactory.

6.2.3.3 Acceptance Testing

Acceptance testing was not performed as it the system will be thoroughly tested in the Viva by the thesis supervisor and moderator. Section to be updated later.

6.2.3.4 Installation Testing

The e-Kimia system is web based but it was not to be uploaded in a actual server. This is because actual servers are charged. Instead Personal Web Server (PWS) was used to simulate the web launching. PWS behaves similarly to actual servers and have web scripting capabilities. The web folder was placed in a folder named wwwroot. The website is launched from url: *http://localhost/3182/Main.asp*. All these were the actual installation testing. The system was developed and tested based on these specifications.

6.2.3.4.1 Hardware Specifications (Development)

a) Processor type and speed – Pentium II 350 Mhz

b) Memory – 128 MB RAM

c) Hard drive space – 20 Gigabytes

d) Display –16 bit color with 800 by 600 resolution

e) Sound – Creative Sound Blaster Live! Value

f) Operating System - Windows 98

g) Web Browser - Internet Explorer 5.0

h) Web Server – Microsoft PWS

6.2.3.4.2 Hardware Specifications (Testing)

i) Processor type and speed – Intel Pentium 900 Mhz

j) Memory – 128 MB RAM

k) Hard drive space – 10 Gigabytes

l) Display –16 bit color with 800 by 600 resolution

m) Sound – Creative AWE

n) Operating System - Windows 98

o) Web Browser - Internet Explorer 5.0

p) Web Server – Microsoft PWS

6.3 Summary

Testing the system is compulsory in order to assure its users that the system is error, bug and flaw free and that the system works perfectly. To achieve the objective of a perfect working system, tests have to been done. The three types of tests done were unit testing, integration testing and system testing.

Unit testing is done to test each component individually. Before the components can be integrated to form a whole system, the components must first be able to function individually and be error free. Next comes integration testing. This is a necessary phase to assure that once integrated, they would be able to function as a whole. Finally, the system testing. System testing is the process of assuring that the system can function with the all other elements such as the hardware and other software.

In the process of testing the system, certain errors were found. This would have caused problems in the system if it was not remedied. However, all errors, bugs and flaws were identified and corrected.

7.0 SYSTEM EVALUATION

7.1 Introduction

System evaluation is a process of evaluating the developed system. It states all the problems faced and their solutions as well, system limitation, system strengths and future enhancements.

7.2 Problems Encountered and Solution

From the initial development phase until the end of the development phase, many problems were faced. Some can be solved by certain solution while some remained unsolved or could not be solved due to a few factors such as hardware limitation, lack of resources and so on.

i) Setting Up and Configuration

Setting up the server which the Personal Web Server , is a initial process for the operator and development of the application. It consumes a lot of time insetting up the server in the project initial stage due to lack of experience. Furthermore the repeated failure of the server require re-installation and reconfiguration of the server, this consumes time and effort.

ii) Requirement Changes

It was difficult to develop and implement the system when the requirement changes very frequently. Sometimes it is easy to change the requirements however, the coding need to

be changed is a lot in order to follow the new requirements. In order to meet the requirement changes of the system, several discussion were made with the thesis supervisor and friends to analyze the changes.

iii) Lack of Resources

Lack of resources such as hardware, people and time, made the system could not be tested on a wider scale. Nevertheless the system was tested sufficiently to ensure quality and performance to users requirements and standards.

iv) Virus Attacks

The platform computer which was used to develop this system performed abnormally due to computer virus attacks. This is because the virus program which was installed was not very good. The virus attacks was a problem and it had effected the progress of the development stage. As a result a lot of time had to be wasted to backup files every time and to scan the hard drives for viruses.

v) Inexperience In Choosing Development Tools

Development tools are most important and critical process in software development cycle. Wide range of tools raise problems on making the decision in choosing the most suitable. Defining systems needs then doing some researches based on what software need to be installed were the steps taken to help the decision making process. At last I

found out there was no such thing as the best tool and decided combining a few was the effective way.

vi) Unfamiliarity of Development Tools Used

During the early stages I faced a lot of problems on the given period of time to complete the project, to learn and master the tools such as programming languages. Constant help from books, Internet and discussion with friends made me to master the development tools.

vii) Lack of Language Mastery

My knowledge on ASP was very low during the initial stages of the project. Uncertainty on how to organize the structure and codes during the coding process. Discussions with friends and learning tutorials from the web helped to overcome this problem. During this process a lot of time was wasted. The learning process never ended until we finished the system.

7.3 Evaluation By End User

Due to time constraint a proper formal end user assessment could no be conducted. An informal method was used. I ask my friends to evaluate the system and got their feedback. After the feedback was examined some modifications were done to enhance the system.

7.4 System Strengths

i) Web Enabled

This system is developed on web technology. Client-server approach that allows processing load to be shared between the client and server thus reducing the burden on the server and allow it to provide better service.

ii) Simplicity of Graphical User Interface (GUI)

Online learning module for STPM Chemistry is simple and easy to be used because all forms of GUI such as menu, buttons, navigation buttons were used to make user interface more simple and clean. This will shorten the process time of the users. Clean and precise instructions guidance is given with each form to guide the user. Even if a mistake was made, the user still can easily aware of the mistakes through the message prompt out by the user.

iii) Authorization and Authentication

Both administrator and user have usernames and passwords. This prevents unauthorized users from accessing the administrator page and the database. Invalid login message will be prompted if the user tries to loin with wrong username or password.

iv) Scalability

Hardware and application could be easily added to the existing system without influencing the existing application. This is because the system is not hardware dependant.

v) System transparency

Refers to the condition where the users do not need to know where the database resides, the system structure, the DBMS or anything related to the system built.

vi) Help feature

My system provides the user simple help and explanation regarding how to use the system. The help feature is very useful especially when using the VRML player.

vii) Support For Concurrent Users

My system is operational in the Internet environment; it supports concurrent users on multiple PCs'. Multiple users access the system at same time.

viii) Able To Provide Database Maintenance

Administrator will be able to do some housekeeping for database maintenance. They can edit, view and delete records.

ix) Easy Accessibility

This system is web based and can be accessed easily using web browser. Web browser needed is minimum Internet explorer 4.0 or higher which comes together with Windows 98 installer.

7.6 Future Enhancements

i) Add Content

As mentioned the system lacks of notes and tests. Additional materials will be added in future. At the same time these materials are checked so it is similar to the current syllabus.

ii) Enhance Glossary

There is a search engine to fine keywords or terms in chemistry. Currently the terms are limited. In future a lot of terms will be added. This search engine also will be made more intelligent so it can search text, pictures, sound and url's based on the input given.

iii) Password Encryption

The password fields are not encrypted. This poses to security risks because the password is not in the confidential form and it can be easily breached. In the future a cookie enabled password protection will be done. The cookie will keep track s that users cannot into or go back to secure pages such as the administrator page.

7.7 Knowledge and Experience Gained

Knowledge and experience gained throughout the project is undoubtedly valuable. It is proven to be useful in the future especially when we step into working world.

i) Improve Project and Time Management

I learned how to manage a project so that it can meet its deadline without sacrificing the applications functionality and quality. Time planning is very important especially in allocating time for a project. I planned a schedule for each tasks because there was time constraints.

ii) Analysis and Design Planning

Literature review, system analysis and design that was done in the documentation helped me how to analyze and plan a project. The flow shows how the programs should run, is sketched and documented.

iii) Good Communication Skills

During the project development I came into interaction with other people. Communication skills are important especially in requirement gathering and analysis. I had to brush up communication skills on expressing ideas and problems related

iv) Good Documentation

Good documentation serves the purpose of supporting testing and maintenance of the system. Changes recorded consistently , while system implementation and testing are conducted based on requirements specification to ensure that no requirements are left out. Once the product is delivered to the user, the documentation can aid in maintenance and enhancement of the system. A user manual is also documented to help beginners and novice users to install and use the system correctly. Thus, we have learned to prepare documentation that adhered to known standards and guidelines.

v) Hands on Experience

Practical experience such as this project given us knowledge us for the actual working environment. As the computing world is constantly evolving and changing, I have take this opportunity to improve my weaknesses and enhance my knowledge.

7.8 Review of Goal

At the final stage of there would be expectation on what would be achieved. The following are the expectation that have been achieved.

Expectation Achieved

Overall, the system fulfilled the expectation stated by the project. The basic foundation of the system is designed and implemented. The system is able to provide the functions needed. It is eligible for future growth and implementation. My system meets the criteria like reliability, user friendliness, open system and wide access.

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USER MANUAL

Part I: Hardware and Software Requirements

1.1 Server Requirements

i. Server Processor – Intel Pentium II/ AMD 300 Mhz or above

ii. Memory – 128 MB RAM or higher

iii. Hard drive space – 20 MB for Installation

iv. Network connection speed – 56.6 Kbps/ LAN 10 Mbps

v. Display – 256 colors with 800 by 600 resolution

vi. Operating System – Windows 98

vii. System Database – MS Personal Web Server

1.2 Client Requirements

i. Processor – At least Intel Pentium 233 Mhz Or AMD

ii. Memory – 64 MB RAM

iii. Hard drive space – 1 BG storage

iv. Network connection speed – 56.6 Kbps

v. Display – 256 colors with 800 by 600 resolution

vi. Operating System – Windows 98

vii. Web Browser – Internet Explorer 5.0 and above

Part II: Administrator Module

2.1 Operating the Administrator Module

1. Open web browser by double clicking on browser icon.
2. Type the websites address (URL) in the address bar and press Enter. Address: *http://localhost/3182/Main.asp*
3. The main access page will appear.
4. Insert a username and password to access the page and press the **Login** button. **Reset** button clears the fields.
5. You will instantly be directed to the Maklumat Pengguna page in the Administrator module.
6. From Maklumat Pengguna page you will be able to edit and delete users records.

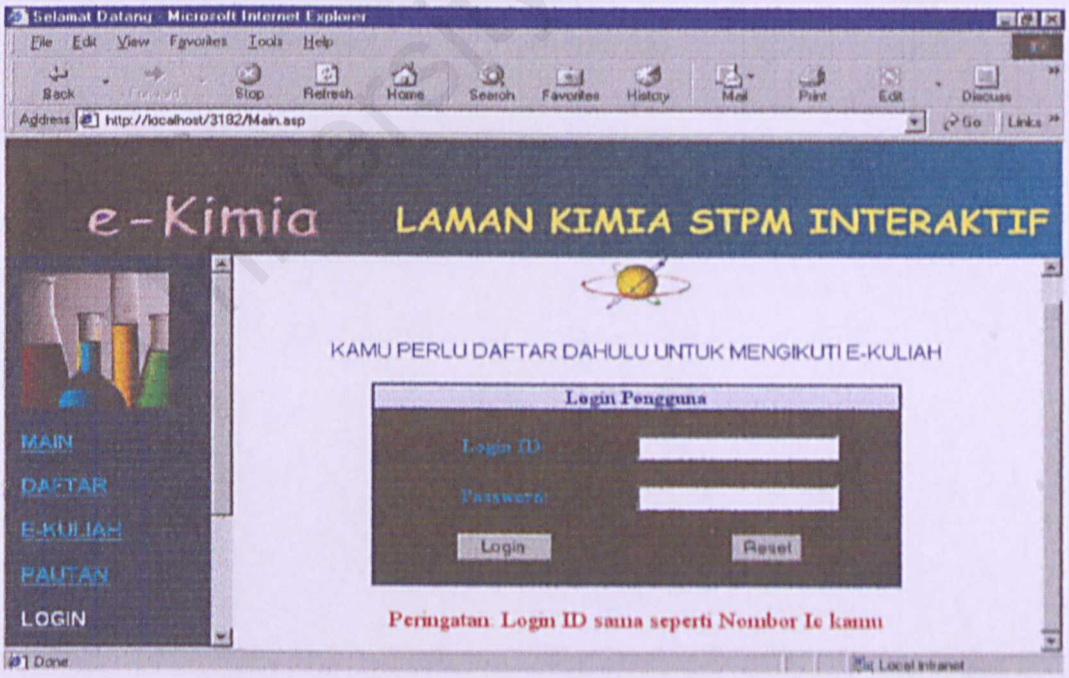

Figure 2.1: Login page

2.3 Editing And Deleting Records

1. Once logged in to the administrators page, you will be redirected to Maklumat Pengguna page.
2. Here you can view names, IC numbers of users who are registered.
3. There are two options, **Edit** for editing records and **Buang** for deleting records.

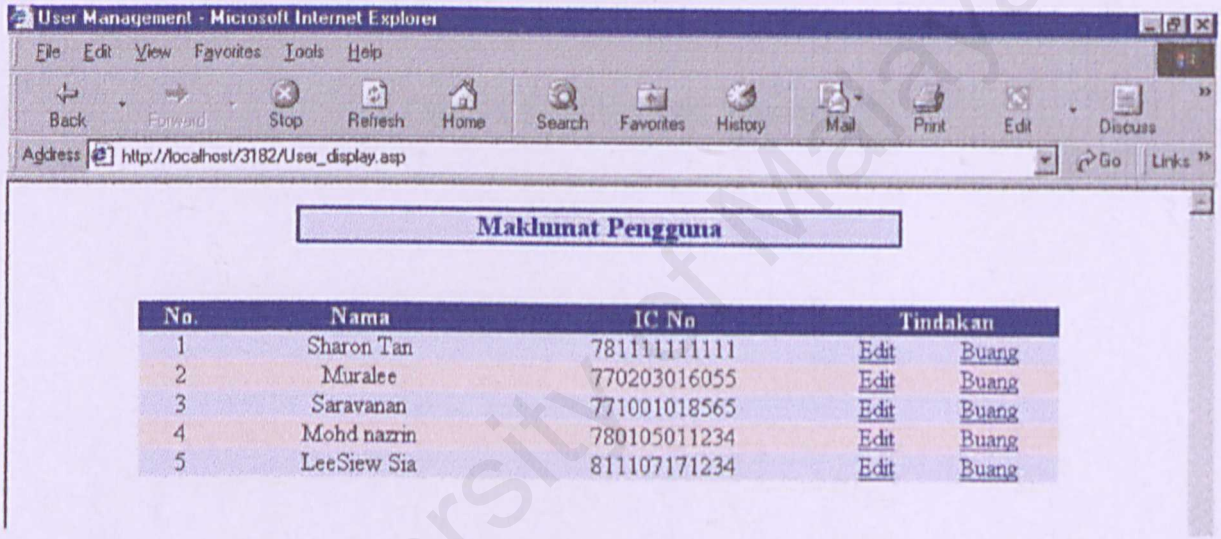

Figure 2.2 Display Record

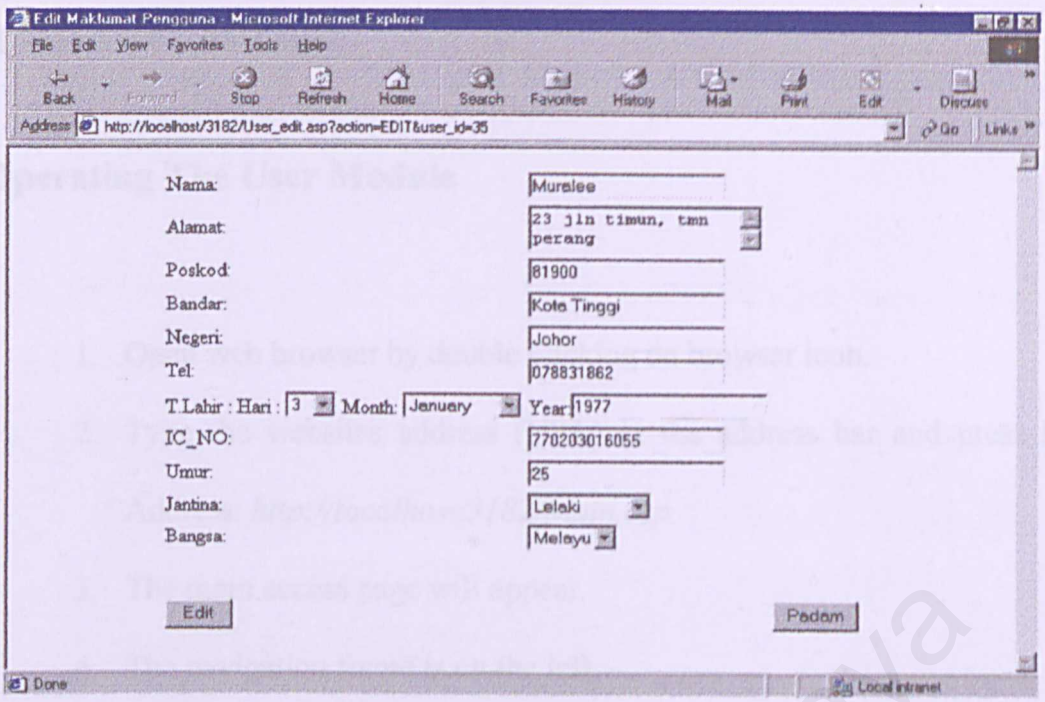

Figure 2.3 Delete/Edit Record

Part III: User Module

3.1 Operating The User Module

1. Open web browser by double clicking on browser icon.
2. Type the websites address (URL) in the address bar and press Enter.

   Address: *http://localhost/3182/Main.asp*
3. The main access page will appear.
4. The navigation frame is on the left.

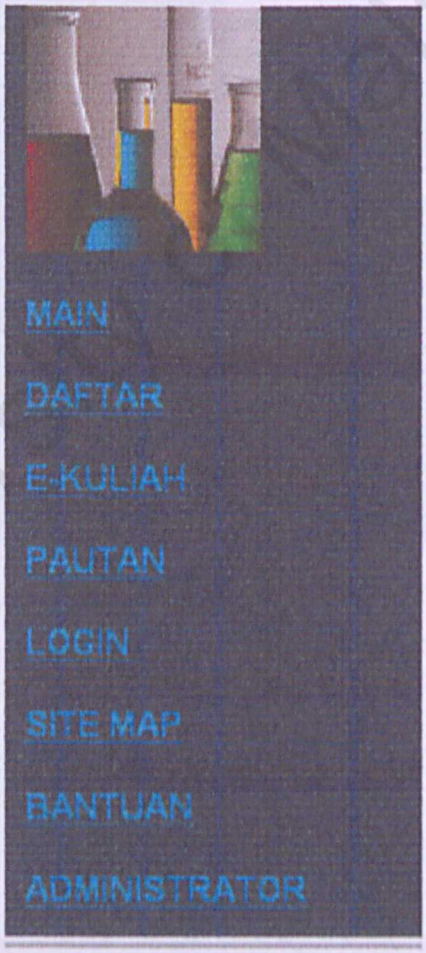

Figure 3.1 Navigation Bar

3.1 Daftar (Registration)

1. In order to access the learning page which has notes, tests and search engine, you must register first.

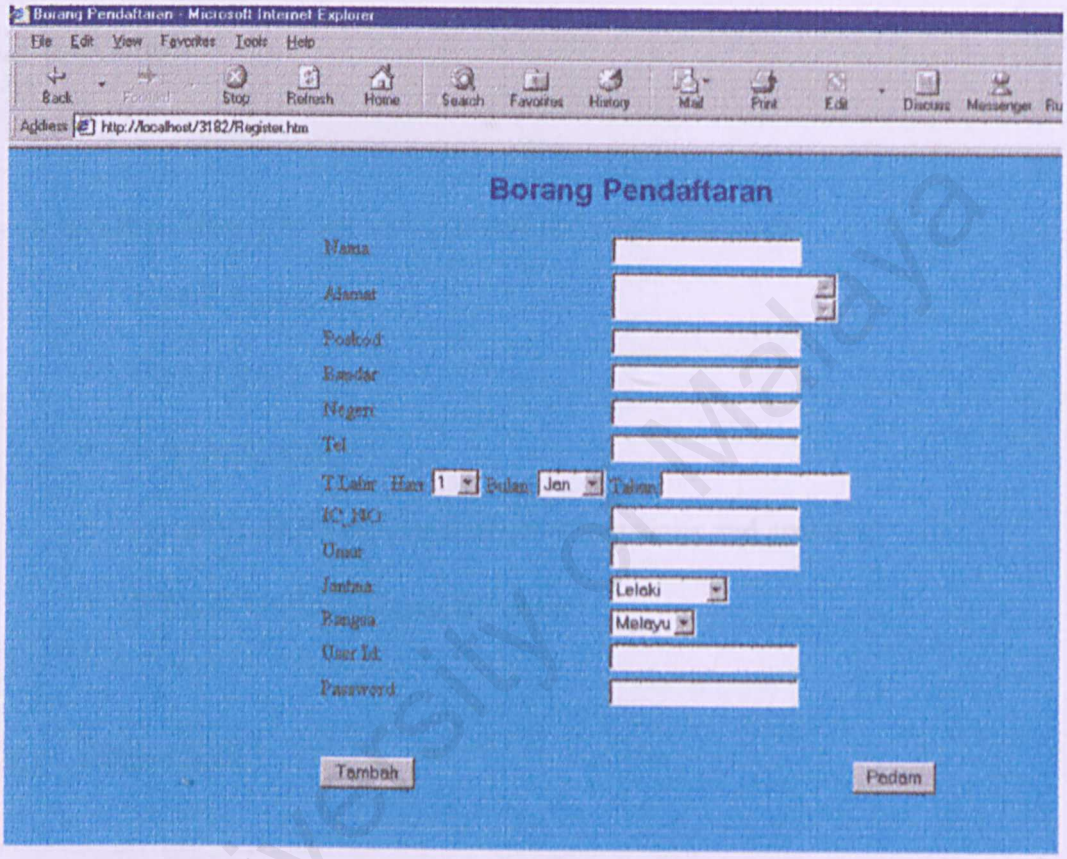

Figure 3.2 Registration Form

2. Input all relevant details. Make sure you set your user Id (same as your Ic number) and password.
3. Press **Tambah** to add this information to the database or **Padam** to clear the fields.
4. Use the User Id and password to log-in to the E-Kuliah page.

3.2 User Login

1. Use the same steps as in administrator login. 2.1 (number 4).

3.3 E-Kuliah

1. Login first. Now you can access e-learning page. It features:
    - TOPIK (notes)
    - UJIAN (test)
    - MAKMAL (lab)
    - SAMPEL SOALAN (collection of questions and answers)
    - ISTILAH (search engine for terms)

3.3.1 Ujian (Test)

1. Choose the topic you want.
2. Answer each question by clicking the radio buttons.
3. Press **SELESAI** button to mark the questions and obtain the score.
4. Click the **semak jawapan** link to view correct answers for each question.
5. You can click the numbers on the number of each answer option to view individual questions.

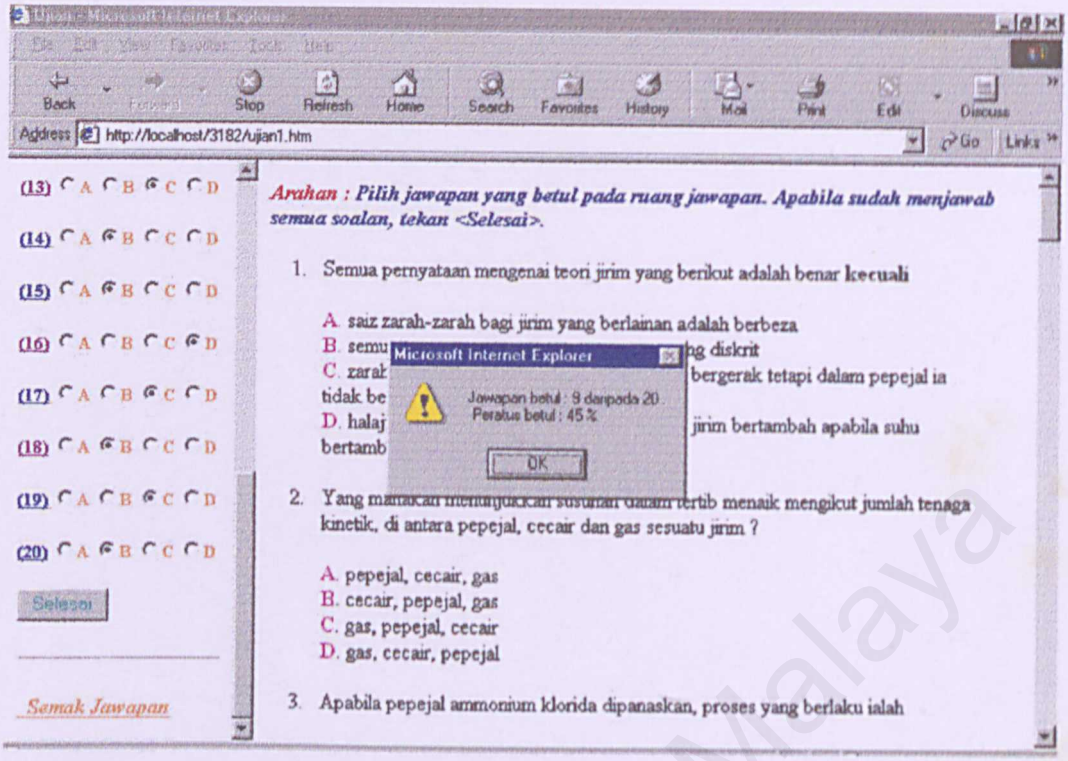

Figure 3.3 Test